

WHAT IS CLAIMED IS:

1. A method for manufacturing a prescribed semiconductor device by forming a film mainly formed of tungsten and a film of a component different from the film
5 mainly formed of the tungsten on a semiconductor substrate, comprising:

forming a first layer, which is formed of the film of the component different from the film mainly formed of the tungsten, on the semiconductor substrate;
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forming a second layer, which is formed of the film mainly formed of the tungsten, on the semiconductor substrate; and

forming an oxide film on an exposed surface of the first layer by plasma processing using a process gas containing
15 oxygen gas and hydrogen gas at a process temperature of 300°C or more.

2. The method for manufacturing a semiconductor device according to claim 1, wherein the semiconductor device is a transistor, and a gate electrode is formed of the first layer and the second layer.
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3. The method for manufacturing a semiconductor device according to claim 1 or 2, wherein the second layer is a tungsten layer or a tungsten silicide layer.

25 4. The method for manufacturing a semiconductor device according to any one of claims 1 through 3, where the first layer is a silicon layer.

5. The method for manufacturing a semiconductor device

according to any one of claims 1 through 4, wherein a flow rate ratio (hydrogen gas flow rate/oxygen gas flow rate) of the hydrogen gas to the oxygen gas of the process gas is 1.5 or more.

5 6. The method for manufacturing a semiconductor device according to any one of claims 1 through 4, wherein a flow rate ratio (hydrogen gas flow rate/oxygen gas flow rate) of the hydrogen gas to the oxygen gas of the process gas is 2 or more and 4 or less.

10 7. A method for plasma oxidation of a film of a component different from a film mainly formed of tungsten of a semiconductor substrate on which the film mainly formed of the tungsten and the film of the component different from the film mainly formed of the tungsten are formed, comprising:

15 forming an oxide film on an exposed surface of the film of the component different from the film mainly formed of the tungsten by plasma processing using a process gas containing oxygen gas and hydrogen gas at a process temperature of 300°C or more.

20 8. The plasma oxidation method according to claim 7, wherein a flow rate ratio (hydrogen gas flow rate/oxygen gas flow rate) of the hydrogen gas to the oxygen gas of the process gas is 1.5 or more.

25 9. The plasma oxidation method according to claim 7, wherein a flow rate ratio (hydrogen gas flow rate/oxygen gas flow rate) of the hydrogen gas to the oxygen gas of the process gas is 2 or more and 4 or less.